# How Common are Habitable Planets in the Galaxy? Connecting Biochemistry, Astrophysics, and Geophysics

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The question of whether habitable planets exist elsewhere in our Galaxy, and whether any of them are inhabited, is a central issue for astrobiology. We restrict our interest to the Milky Way Galaxy, as opposed to the universe, as theories need to be testable in order to be interesting, and the only tests that have been devised so far apply to stars within our galaxy. Indeed, the greatest interest is centered on relatively nearby stars that can be surveyed remotely by telescopes on or near Earth. Intelligent civilizations beaming radio signals at us could be detected on the far side of the galaxy but that is not, and should not be, a major focus of astrobiology. We further restrict our attention to planets that are habitable *at their surfaces*. Subsurface life could exist on other planets or moons within our own Solar System, but we have no way of knowing this without exploring them in-situ. (A possible exception to this argument is posed by the apparent spectroscopic detection of ~10 ppbv $CH_4$ in Mars' atmosphere. We assume, however, that such a faint signature could not be observed on an extrasolar planet.) If we further assume that life requires liquid water, then the planets of interest are those that have orbits within the conventional *habitable zone (HZ)*, or *ecosphere*, around their parent star. We argue here that HZ's around sun-like stars are relatively wide, at least for planets like Earth, because such planets have active climate stabilization mechanisms that can be either abiotic or biotic. Thus, from this perspective the chances of finding other habitable planets are reasonably good.